Space Weather Technical Forecast

Issued on Monday, 29 April 2024 at 13:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: A chance of further M-flares and slight chance of X-flares through the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity returned to Moderate levels following renewed M-class activity, peaking at M3.7 at 29/0111 UTC from AR3654. This region also produced several other upper C-class flares during the period, including a C8.3 at 28/2020 UTC. There remain seven sunspot regions on the visible disc, six of which are currently numbered. AR3654 in the western disc continues to dominate the flare risk. This region continues to show further development in its intermediate portion in recent hours and retains a broad delta spot configuration here. Remaining sunspot regions are all relatively small and simple. A new spot region continues to emerge at the northeast limb and numbered AR3661 and tentatively assigned an Hsx/Alpha classification with another small region emerging in the northeast. AR3644 and AR3646 ceased to be visible as they moved towards the limb.

No clearly Earth directed CMEs were observed in available imagery although analysis ongoing for several faint dimming events.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE/DSCOVR at L1 have been variable but on an overall mostly steady trend, between 410-480km/s. Density has been mostly average. The Interplanetary Magnetic Field was weak, mainly 5-7 nT. The north-south component, Bz, also varied weakly -5/+6 nT. Phi angle was mostly positive (away from the Sun) with some brief negative (toward the Sun) periods. Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence was well below the Active threshold, with a slight rising trend. Observed fluence at 29/0001UTC was 4.51e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: A chance of M-flares and a slight chance of X-flares is maintained though the period, this mainly in association with AR3654.

Solar Wind / Geomagnetic Activity: A CME which originated late on 26 Apr from an area of plage and a filament eruption in the southeast of the disc, could give a glancing blow early on day 2 (30 Apr).

Solar winds will likely continue at slightly elevated levels over the next couple of days, with further weak coronal hole influences from CH29/+ possible. Later on day 3 into day 4 (1-2 May) a potential connection comes from the increasingly narrow trans-equatorial coronal hole CH31/-, which may become geoffective.

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Geomagnetic activity is expected to be largely Quiet at first, but with Unsettled periods likely on days 3-4 (1-2 May) as CH31/- perhaps becomes geoeffective. There is also a slight chance of isolated Active to G1/Minor Storm intervals on day 2 (30 Apr), should the possible glancing CME mentioned above materialise.

Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at background levels through this period. There is a slight chance for an S1 or greater event, with AR3654 posing the main risk as it continues to rotate westwards.

High energy electron flux likely remaining at generally Background to Moderate levels, with the associated fluence expected to remain below the Active (1e8 integrated pfu) threshold throughout.

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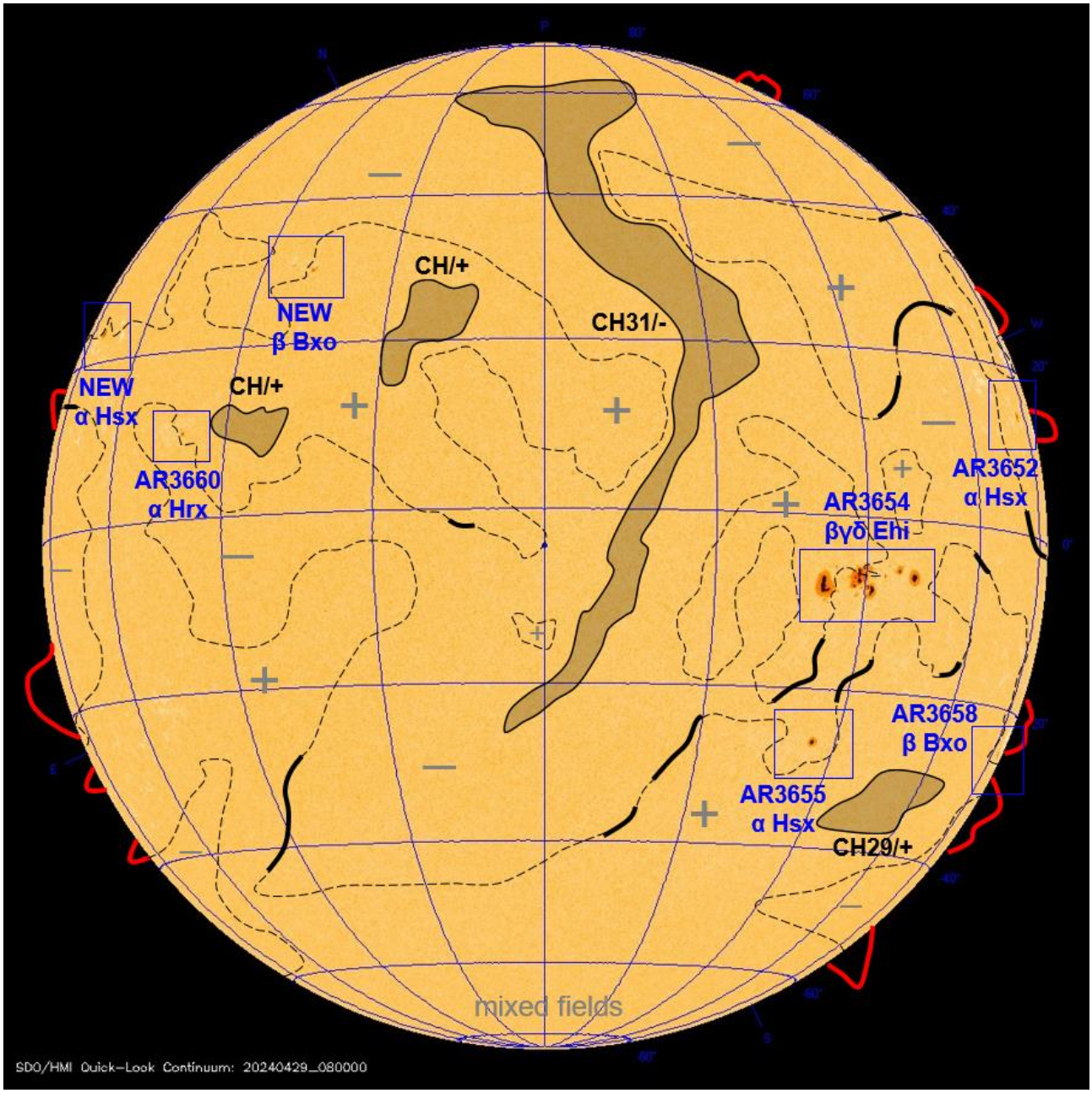
Figure 1. Solar Analysis Valid 29/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

There is currently one CME potentially featuring in the forecast, this starting around 26/1830 UTC and emerged from an area of plage in the southeast of the disc, likely associated with a filament eruption. The resulting CME is modelled as mostly passing behind and below Earth's orbit, but there is a slight chance of a peripheral glancing blow on day 2 (30 Apr).

Solar winds have been at slightly elevated levels, and further weak coronal hole influences from CH29/+ are possible in the next couple of days. Later on day 3 into day 4 (1-2 May) a potential connection comes from the increasingly narrow trans-equatorial coronal hole CH31/-, which may become geoffective. This is a recurrent feature which gave Unsettled geomagnetic conditions on the last rotation, but appears slightly weaker and perhaps somewhat delayed this rotation. Geomagnetic activity is expected to be largely Quiet at first, but with Unsettled periods likely on days 3-4 (1-2 May) as CH31/- perhaps becomes geoeffective. There is also a slight chance of isolated Active to G1/Minor Storm intervals on day 2 (30 Apr), should the possible glancing CME mentioned above materialise.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0402	Partial	Filament	SE	472 km/s	30/1200 UTC	Slight glancing blow possible

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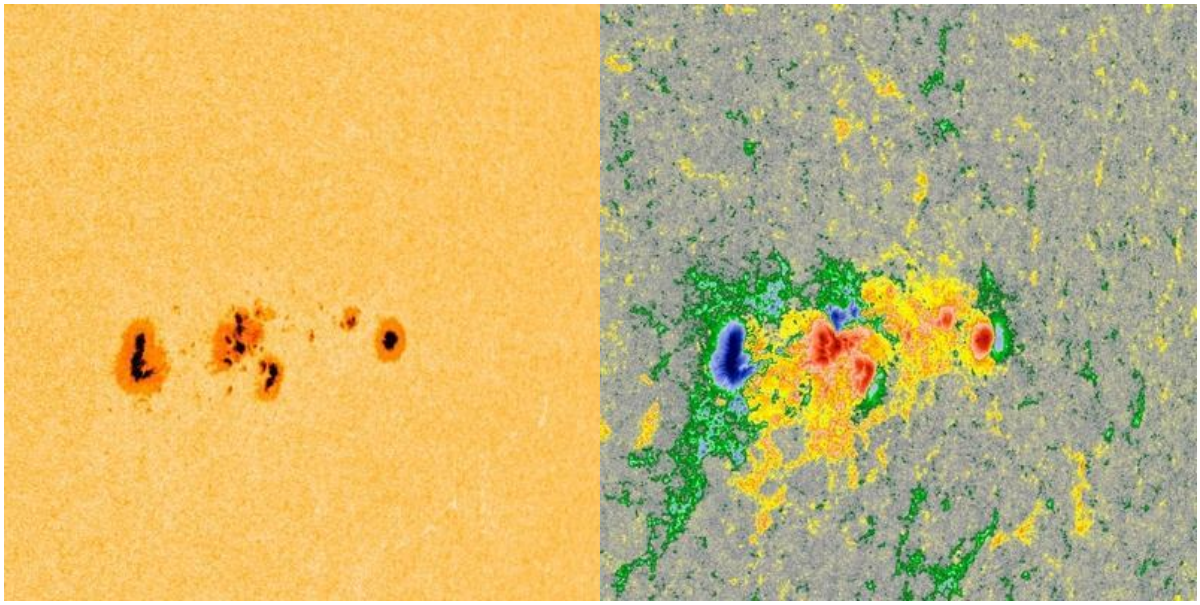
Radio Blackouts - X-Ray Flares:
The large AR3654, located in the west of the visible disc, continues to dominate the flare risk and has been the source of the most recent M-class activity, along with several upper C-class flares in the past 24 hours. Further development in the intermediate portion of this region has been observed over the past 24 hours, and it retains a broad delta spot configuration here. Remaining sunspot regions are all relatively small and simple, contributing little to the total flare risk at present.

No significant returning regions are expected through the period with limited signals in far-side helioseismographs. Recently numbered small regions emerging at the northeast limb likely balancing the loss of several small regions in the west, with AR3654 remaining on the visible disk throughout the period pending further developments. Overall, a chance of further M-flares is maintained through the period, with a slight chance of isolated X-flares, this mainly from AR3654.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 2: Latest SDO/HMI intensity and magnetogram imagery of AR3654 showing large delta (mixed polarity region) with the northern intermediate complex



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. There is a slight chance for an S1 or greater event however, most likely associated with any large flares from AR3654 as it continues to rotate westwards.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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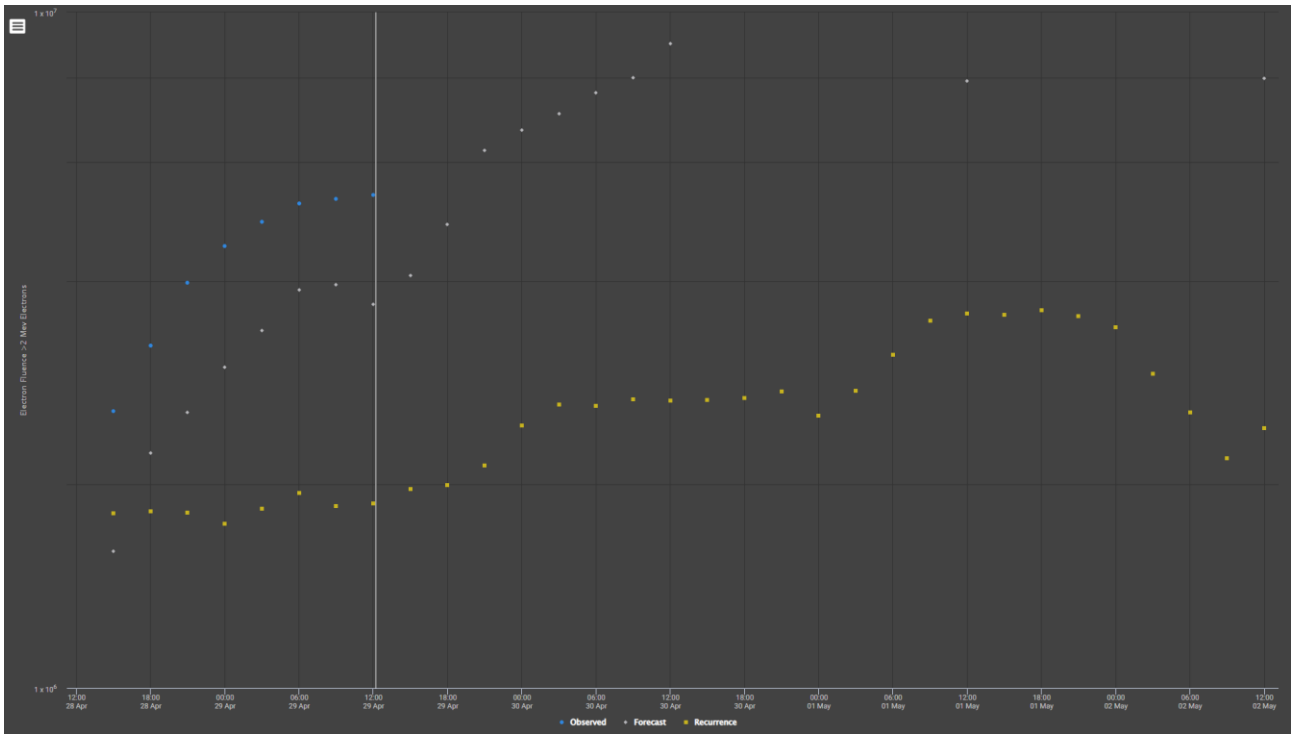
High Energy Electrons Event (≥ 2MeV):
High energy electron flux has been at background to moderate levels. There may be a slight rising trend in flux levels in the next couple of days, with any potential coronal hole influences expected to be weak. However, later on day 3 (1 May) CH31/- may become geoeffective, and there is also a low chance of a peripheral CME glance on day 2 (30 Apr). Either of these features may tend to reduce electron counts if we see any more significant geomagnetic enhancement.

The 24 hour integrated electron fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but likely with a slight rising trend initially. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM output



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